



# STAT680

## Applied Statistics

S2 Evening 2016

*Dept of Statistics*

### Contents

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|                                       |   |
|---------------------------------------|---|
| <u>General Information</u>            | 2 |
| <u>Learning Outcomes</u>              | 2 |
| <u>General Assessment Information</u> | 3 |
| <u>Assessment Tasks</u>               | 3 |
| <u>Delivery and Resources</u>         | 6 |
| <u>Unit Schedule</u>                  | 7 |
| <u>Policies and Procedures</u>        | 8 |
| <u>Graduate Capabilities</u>          | 9 |

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#### **Disclaimer**

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## General Information

Unit convenor and teaching staff

Unit Convenor

Justin Wishart

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Level 2, Australian Hearing Hub

Wednesday 3-5pm

Credit points

4

Prerequisites

Admission to MAppStat or GradDipAppStat

Corequisites

STAT670

Co-badged status

STAT680

Unit description

This unit aims to extend and broaden statistical experience from STAT670, with a focus on application to real-world analysis. It covers relationships between categorical or continuous explanatory variables and a continuous response variable using the techniques of one-way and two-way analysis of variance and simple and multiple linear regression. Data management, report writing, graphical presentation of results, and power analysis are described.

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

## Learning Outcomes

On successful completion of this unit, you will be able to:

Produce and interpret appropriate visual displays and numerical summaries

Understand and apply appropriate statistical methods and models to provide answers to research questions. Models include one way ANOVA, two way ANOVA, simple regression, and multiple regression.

Understand the assumptions underlying the models, and how they can be checked and, if invalid, how to modify the analysis.

Use statistical software to fit the models.

Understand and apply the nonparametric regression method of kernel smoothing for data where simple linear and multiple regression methods are inappropriate.

## General Assessment Information

Students are required to submit all their in-session assessments via the TurnItIn interface on iLearn.

Students who have not submitted the task prior to the deadline will be awarded a mark of 0 for the task. No extensions will be granted, except for cases where a student has a **serious and unavoidable** disruption to studies. In this case, an application for disruption of studies is required from the student on the ask.mq.edu.au system and needs to be approved by the Lecturer in charge.

The supported statistical software for this unit is R/RStudio. Students will be given guidance on how to use this software and be expected to conduct their analyses using R/RStudio for the in-session assessments. Students should also note that the final examination will involve data analysis that contains inline R code that students need to interpret to answer the exam questions.

Students are advised that it is Macquarie University policy not to set early examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, i.e. the final day of the official examination period.

The only excuse for not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these special circumstances you may apply for Disruption to Studies via ask.mq.edu.au. A supplementary examination will only be granted if the student has been found to have had a significant disruption to studies. If a supplementary examination is granted as a result of the disruption to studies process, the examination will be scheduled approximately two weeks after the conclusion of the official examination period.

Students can submit disruption to studies request(s) through the following link: <http://ask.mq.edu.au/>

## Assessment Tasks

| Name                                      | Weighting | Due     |
|---|-----------|---------|
| <a href="#">Tutorial Exercises Week 3</a> | 4%        | Week 4  |
| <a href="#">Assignment 1</a>              | 11%       | Week 7  |
| <a href="#">Assignment 2</a>              | 15%       | Week 12 |

| Name                | Weighting | Due                |
|---------------------|-----------|--------------------|
| <u>Assignment 3</u> | 10%       | Week 13            |
| <u>Final exam</u>   | 60%       | Examination period |

## Tutorial Exercises Week 3

Due: **Week 4**

Weighting: **4%**

The first assessment will be completing the week 3 tutorial exercises and is due at 5pm on Wednesday in Week 4. The exercises will assess:

- The review material covered in Weeks 1-2 of lectures.
- Ability to use statistical software to conduct statistical analyses.

On successful completion you will be able to:

- Produce and interpret appropriate visual displays and numerical summaries
- Understand and apply appropriate statistical methods and models to provide answers to research questions. Models include one way ANOVA, two way ANOVA, simple regression, and multiple regression.
- Understand the assumptions underlying the models, and how they can be checked and, if invalid, how to modify the analysis.
- Use statistical software to fit the models.

## Assignment 1

Due: **Week 7**

Weighting: **11%**

The first Assignment will be due 5pm on Wednesday in Week 7. The assignment will cover:

- Material covered in lectures from Weeks 1 - 5.
- Ability to use statistical software to conduct statistical analyses.

On successful completion you will be able to:

- Produce and interpret appropriate visual displays and numerical summaries
- Understand and apply appropriate statistical methods and models to provide answers to research questions. Models include one way ANOVA, two way ANOVA, simple regression, and multiple regression.
- Understand the assumptions underlying the models, and how they can be checked and, if invalid, how to modify the analysis.

- Use statistical software to fit the models.

## Assignment 2

Due: **Week 12**

Weighting: **15%**

The second Assignment will be due 5pm on Wednesday in Week 12. The assignment will cover:

- Material covered in lectures from Weeks 7-10.
- Ability to use statistical software to conduct statistical analyses.

On successful completion you will be able to:

- Produce and interpret appropriate visual displays and numerical summaries
- Understand and apply appropriate statistical methods and models to provide answers to research questions. Models include one way ANOVA, two way ANOVA, simple regression, and multiple regression.
- Understand the assumptions underlying the models, and how they can be checked and, if invalid, how to modify the analysis.
- Use statistical software to fit the models.

## Assignment 3

Due: **Week 13**

Weighting: **10%**

The third Assignment will be due 5pm on Wednesday in Week 13. It will be based on the additional nonparametric regression material available on iLearn. The assignment will cover:

- Nonparametric kernel smoothing regression methods.
- Ability to use statistical software to conduct statistical analyses.

On successful completion you will be able to:

- Understand and apply the nonparametric regression method of kernel smoothing for data where simple linear and multiple regression methods are inappropriate.

## Final exam

Due: **Examination period**

Weighting: **60%**

The Final Examination will be a three hour written exam (plus ten minutes reading time) and will be held during the examination period. The relevant statistical tables will be attached to the examination paper. Students will be permitted to take **one A4 sheet, handwritten** into the final examination. This sheet can be one-sided or two sided. This sheet **must** be submitted with your

final exam paper at the conclusion of the final exam. The final exam will assess all topics of STAT270.

The University Examination timetable will be available in draft form approximately eight weeks before the commencement of the examinations and in final form approximately four weeks before the commencement of the examinations at: <http://www.timetables.mq.edu.au/>

On successful completion you will be able to:

- Produce and interpret appropriate visual displays and numerical summaries
- Understand and apply appropriate statistical methods and models to provide answers to research questions. Models include one way ANOVA, two way ANOVA, simple regression, and multiple regression.
- Understand the assumptions underlying the models, and how they can be checked and, if invalid, how to modify the analysis.

## Delivery and Resources

### Textbook

There is no prescribed textbook.

### Software

You will be required to use R/RStudio to perform data analyses. You will use R/RStudio as part of the tutorials, and you can use the software in the E4B labs when they are not booked for classes. You can find more information on RStudio at their web site: <https://www.rstudio.com/>. The software is freely available to download at no cost for all standard operating systems (Windows, Mac OS and Linux) at <https://www.rstudio.com/products/rstudio/download/>.

### Additional References

These recommended books are available in Reserve at the library.

- Moore, D.S., McCabe, G. P. and Craig, B.A. (2014) Introduction to the Practice of Statistics, Eighth Edition (W.H. Freeman)
- De Veaux, R.D., Velleman, P.F. and Bock, D.E. (2004) Stats Data and Models (Pearson)
- Ramsay, F.L. and Schafer, D.W. (2002) The Statistical Sleuth (Wadsworth)

There are other books that are useful but not guaranteed to be available in Reserve at the library.

- Anderson, J. and Poole, M. (2002) Thesis and Assignment Writing (Wiley)
- Chatterjee, S. Hadi, A. and Price, B. (2006) Regression Analysis By Example (Wiley)
- Devore, J. and Peck, R (2005) Statistics The Exploration and Analysis of Data (Brooks/Cole)
- Utts, J.M. and Heckard, R. F. (2004) Mind on Statistics, (Duxbury Press)

- Utts, J.M. and Heckard, R. F. (2006) Statistical Ideas and Methods, (Duxbury Press)

### Online Textbooks

- SurfStat at <http://surfstat.anu.edu.au/surfstat-home/surfstat.html> is a complete introductory statistics course.
- HyperStat Online at <http://davidmlane.com/hyperstat/index.html> is at an intermediate level stats course covering ANOVA.
- StatSoft Electronic Textbook at <http://www.statsoft.com/textbook/stathome.html> is more advanced and material is covered in sections called ANOVA/MANOVA and Linear Regression.

## Unit Schedule

| Week (begins) | Lectures  | Work due       |
|---------------|---|----------------|
| 1 (1 Aug)     | Review: One sample tests and one sided tests;           |                |
| 2 (8 Aug)     | Review: Two sample tests and validation                 |                |
| 3 (15 Aug)    | One way ANOVA   |                |
| 4 (22 Aug)    | One way ANOVA, Multiple comparisons and Transformations | Tutorial Ex 3. |
| 5 (29 Aug)    | Transformations; Non-parametrics; Power and Sample Size |                |
| 6 (5 Sept)    | Data collection and management; Revision                |                |
| 7 (12 Sept)   | Simple linear regression and transformations            | Assignment 1   |
|               | Mid-Semester Break                                      |                |
| 8* (4 Oct)    | Multiple regression                                     |                |
| 9 (10 Oct)    | Regression - Leverage and Influence                     |                |
| 10 (17 Oct)   | Two-way ANOVA   |                |
| 11 (24 Oct)   | Two-way ANOVA continued and Multiple comparisons        |                |
| 12 (31 Oct)   | ANOVA - Regression connection                           | Assignment 2   |
| 13 (7 Nov)    | Revision  |                |
|               | <i>*Public Holiday Monday 3rd October</i>               |                |

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](#). Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy [http://mq.edu.au/policy/docs/academic\\_honesty/policy.html](http://mq.edu.au/policy/docs/academic_honesty/policy.html)

**New Assessment Policy in effect from Session 2 2016** [http://mq.edu.au/policy/docs/assessment/policy\\_2016.html](http://mq.edu.au/policy/docs/assessment/policy_2016.html). For more information visit [http://students.mq.edu.au/events/2016/07/19/new\\_assessment\\_policy\\_in\\_place\\_from\\_session\\_2/](http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/)

Assessment Policy prior to Session 2 2016 <http://mq.edu.au/policy/docs/assessment/policy.html>

Grading Policy prior to Session 2 2016 <http://mq.edu.au/policy/docs/grading/policy.html>

Grade Appeal Policy <http://mq.edu.au/policy/docs/gradeappeal/policy.html>

Complaint Management Procedure for Students and Members of the Public [http://www.mq.edu.au/policy/docs/complaint\\_management/procedure.html](http://www.mq.edu.au/policy/docs/complaint_management/procedure.html)

Disruption to Studies Policy [http://www.mq.edu.au/policy/docs/disruption\\_studies/policy.html](http://www.mq.edu.au/policy/docs/disruption_studies/policy.html) *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the [Learning and Teaching Category](#) of Policy Central.

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: [https://students.mq.edu.au/support/student\\_conduct/](https://students.mq.edu.au/support/student_conduct/)

## Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in [eStudent](#). For more information visit [ask.mq.edu.au](http://ask.mq.edu.au).

## Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

## Learning Skills

Learning Skills ([mq.edu.au/learningskills](http://mq.edu.au/learningskills)) provides academic writing resources and study strategies to improve your marks and take control of your study.

- [Workshops](#)
- [StudyWise](#)
- [Academic Integrity Module for Students](#)



- [Ask a Learning Adviser](#)

## Student Services and Support

Students with a disability are encouraged to contact the [Disability Service](#) who can provide appropriate help with any issues that arise during their studies.

## Student Enquiries

For all student enquiries, visit Student Connect at [ask.mq.edu.au](http://ask.mq.edu.au)

## IT Help

For help with University computer systems and technology, visit [http://www.mq.edu.au/about\\_us/offices\\_and\\_units/information\\_technology/help/](http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/).

When using the University's IT, you must adhere to the [Acceptable Use of IT Resources Policy](#). The policy applies to all who connect to the MQ network including students.

## Graduate Capabilities

### Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

#### Learning outcomes

- Produce and interpret appropriate visual displays and numerical summaries
- Understand and apply appropriate statistical methods and models to provide answers to research questions. Models include one way ANOVA, two way ANOVA, simple regression, and multiple regression.
- Understand the assumptions underlying the models, and how they can be checked and, if invalid, how to modify the analysis.
- Use statistical software to fit the models.

#### Assessment tasks

- Tutorial Exercises Week 3
- Assignment 1
- Assignment 2
- Assignment 3
- Final exam

## Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

### Learning outcomes

- Produce and interpret appropriate visual displays and numerical summaries
- Understand and apply appropriate statistical methods and models to provide answers to research questions. Models include one way ANOVA, two way ANOVA, simple regression, and multiple regression.
- Understand the assumptions underlying the models, and how they can be checked and, if invalid, how to modify the analysis.
- Use statistical software to fit the models.
- Understand and apply the nonparametric regression method of kernel smoothing for data where simple linear and multiple regression methods are inappropriate.

### Assessment tasks

- Tutorial Exercises Week 3
- Assignment 1
- Assignment 2
- Assignment 3
- Final exam

## Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to have a level of scientific and information technology literacy.

This graduate capability is supported by:

### Learning outcomes

- Produce and interpret appropriate visual displays and numerical summaries
- Understand and apply appropriate statistical methods and models to provide answers to

research questions. Models include one way ANOVA, two way ANOVA, simple regression, and multiple regression.

- Understand the assumptions underlying the models, and how they can be checked and, if invalid, how to modify the analysis.
- Use statistical software to fit the models.

## Assessment tasks

- Tutorial Exercises Week 3
- Assignment 1
- Assignment 2
- Assignment 3
- Final exam

## Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

## Learning outcomes

- Understand and apply appropriate statistical methods and models to provide answers to research questions. Models include one way ANOVA, two way ANOVA, simple regression, and multiple regression.
- Understand the assumptions underlying the models, and how they can be checked and, if invalid, how to modify the analysis.
- Use statistical software to fit the models.
- Understand and apply the nonparametric regression method of kernel smoothing for data where simple linear and multiple regression methods are inappropriate.

## Assessment tasks

- Tutorial Exercises Week 3
- Assignment 1
- Assignment 2
- Assignment 3
- Final exam

## Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication technologies as appropriate.

This graduate capability is supported by:

### Learning outcome

- Understand and apply the nonparametric regression method of kernel smoothing for data where simple linear and multiple regression methods are inappropriate.

### Assessment tasks

- Assignment 1
- Assignment 2
- Assignment 3
- Final exam